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Chemical Engineering

World congress reflects influ... of global concerns Pag...

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■ **UN inspectors visiting Iraq's largest chemical weapons facility at Samarra uncover four times more weapons and chemical agents than Iraq declared.** Page 5

■ **House subcommittee assails University of California for mismanagement and waste in its operation of two national labs for the Department of Energy.** Page 6

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Business

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New AIDS drug, dideoxyinosine (DDI), is likely to receive Food & Drug Administration approval for marketing. **Page 14**

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Science/Technology

4th World Congress of Chemical Engineering, held this summer in Karlsruhe, Germany, portrays a discipline that is responding at many technical levels to worldwide concerns, including energy, the environment, plant safety, and product quality. **Page 16**

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LETTERS

Perfluorocarbons

The featured letter under the title "Chemical Safety" (C&EN, June 10, page 2) asks suppliers to "heighten users' awareness of the reactivity of perfluorocarbons with oxidizers." The letter states that when a substrate was being oxidized "in a supposedly inert perfluorocarbon liquid," considerably more energy was released than anticipated. The letter also refers to conversations with knowledgeable coworkers who "indicated that perfluorinated organic compounds are more reactive with oxidizers—particularly oxygen gas—than is widely believed." No data are given and no proof is given that the perfluorocarbon was indeed involved.

These statements should be considered along with almost 50 years of experience of saturated perfluorocarbons and chloroperfluorocarbons in oxygen and other oxidizing service without any reports of exothermic reactions. These materials, when subjected to ASTM G72-82 "Standard Test Method for Autogenous Ignition Temperature of Liquids and Solids in a High-Pressure Oxygen-Enriched Environment," do not ignite throughout the entire test range, reaching over 400 °C in the presence of 2000 psig of oxygen.

It appears that before any recommendations in the safety letter on perfluorinated organic compounds are implemented, significantly more information is needed.

Louis L. Ferstandig
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High school chemistry teachers

I was most pleased to read Michael P. Doyle's ACS Comment, "Value of high school chemistry teachers" (C&EN, May 20, page 31). The society has advanced rapidly in its understanding and actions regarding these teachers. In earlier times, high school chemistry teachers were allowed full membership in ACS only if their application was endorsed by two Ph.D. chemist members of ACS; and the *Journal of Chemical Education* was the only resource available to them through the Division of Chemical Education. This division continues to be incorporated separately from ACS with almost informal ties to the parent organization. Since the initiation of the ChemCom (high school chemistry program) by W. Thomas Lippincott and Sylvia Ware in 1981, and the subsequent appointment of Ware to the position of education director for ACS, the society has initiated a number of services useful both to high school chemistry teachers and to other teachers of school science.

Because there were so many earlier years of neglect by ACS for the professional needs of high school chemistry teachers, some ACS sections developed somewhat independent chemistry teacher affiliates. The Philadelphia and North Jersey sections, for example, offer "affiliate teachers" professional meetings, science days, newsletters, and so forth. The ACS education office does service these affiliates, only when requested, with newsletters such as *ChemMatters* and *Chemunity*. The local affiliate dues remain with each local affiliate.

Even with the best of intentions by ACS at the national level to better serve the needs of teachers of chemistry at the high school level, past history dictates that simply and bluntly offering a reduced dues structure will not increase regular membership substantially. Historical practice has developed somewhat of an ACS foster parent relationship for these teachers. Regular membership now, at a reduced dues rate, would not offer membership services beyond those available presently through the affiliate structure at a rate far below the national dues level. Put another way, competing forces already are in operation.

To enhance the profession of chemistry through service to high school chemistry teachers, the objective of the ACS Committee on Membership Affairs would be met best by placing the following plan into action:

1. Support the expansion of the existing Chemistry Teacher Affiliate groups.

Correction

• June 17, page 16: The work on control of ionization by laser interference was reported in *J. Chem. Phys.*, **94**, 8622 (1991), not page 2640.

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German Firms Continue To Dominate Global Top 50 Chemical Producers

World's top 50 chemical producers garnered a 6% sales increase in 1990 to $319 billion as profit margins fell, often to less than 10%

Patricia L. Layman, C&EN London

The U.S. has more large chemical producers than any other nation, although that number has fallen slightly since 1989. For any single region, however, Europe is home to the largest block of producers, and those companies dominate worldwide chemical sales.

Those are the two major conclusions from the second annual C&EN ranking of the world's 50 largest chemical producers. The ranking uses the same criteria as those used for the 100 largest U.S. chemical producers (C&EN, May 6, page 11). Thus, wherever possible, it excludes formulated products, such as coatings and pharmaceuticals, and specialty equipment, energy, and other nonchemical operations.

The total sales rung up by the 50 companies in 1990 were $319 billion, a 6% increase over their total 1989 sales. Nearly one fifth—$61.8 billion—of the total was accounted for by Germany alone, which has five companies in the top 50, including three in the first five.

The U.S. continued to account for the largest number of companies in the ranking—16. This, however, was a decline of two from 1989. The next largest block was Japan, with 11 companies, up from 10 in 1989. Europe, as a region, had 22 companies, and the only other country, Saudi Arabia, the remaining one.

The ranking also points out the importance to the industry of the chemical operations of oil companies. There were 10 such chemical units or subsidiaries of oil companies in the ranking, accounting for 23% of the total group sales, $73.9 billion.

The ranking focuses on performance in 1990—not a good year for the global chemical industry. Already facing a downturn in demand and sagging prices, the industry was further battered by the impact of Iraq's invasion of Kuwait, which sent raw material prices into wild gyrations. The result was as anticipated. Operating profits as a percentage of sales declined significantly throughout the industry.

Only the chemical divisions of General Electric in the U.S., and of Anglo-Dutch Unilever Co., for example, showed operating profit margins in the vicinity of 20%. Much more common were operating margins in the low teens—or even less than 10%, a decided fall from 1989 rankings (C&EN, Nov. 5, 1990, page 20).

Now companies are turning their attention to cutting costs, and trying to put through firmer prices, among other things. However, they know there is little they can do while so many of the world's major economies are in recession. And for now, corporate management finds the future to be somewhat cloudy. One thing they agree on, however, is that the end of the recession will be later than predicted by the world's politicians.

In mid-July, for example, following the meeting of the "Group of Seven"—leaders from the U.S., the U.K., France, Germany, Japan, Canada, and Italy—the official declaration proclaimed, "A global recession has been avoided. The uncertainty created by the [Persian] Gulf crisis is behind us. We welcome the increasing signs of economic recovery."

The daily newspapers in Europe—many of whose countries are suffering through tough economic times—were quick to pick up the message, of "Better times are on the way," as one headline put it, with the year ahead bringing a return to economic growth, stable prices, lower interest rates, and more jobs.

However, speaking at the press conference for ICI's half-year results, Sir Denys H. Henderson, chairman of the British chemicals giant, said the economy will remain sluggish through the end of 1992. "Demand is still flat. In the U.S., there are some signs of improvement, with cars and housing, and some pickup in textiles." And in Europe, where many of the chemical industry's markets have been "awful," there is some slight glimmer of movement, he said.

"Put all that together—there will be a slight pickup by the turn of the year—but is that November-December, or January-February? It will be sluggish through 1992, but my crystal ball is cloudy after that," said Henderson.

The British and German economies have provided the two poles of performance in Europe in 1990–91. Germany's output, including that of chemicals, has grown because of demand from the former East German states. The British economy, on the other hand, has been in the grips of recession. When the Association of British Chambers of Commerce, for example, published its second-quarter 1991 quarterly economic survey late in July, the conclusion was a bleak echo of Henderson's predictions: no upturn until mid-1992, at the very earliest.

Other executives in the European industry say that although the slowdown that hit their industry hit Britain hardest, it has nonetheless had an impact elsewhere in Europe. As one executive points out, "Our business was strong in the fourth quarter of

European chemical producers lead as world's largest

Rank 1990	Rank 1989		Chemical net sales ($ millions)	Chemical sales as % of total sales	Chemical operating profits ($ millions)	Chemical operating profit margin[a]
1	1	BASF (Germany)	$18,520	64.4%	na	na
2	3	Hoechst (Germany)	17,804	64.3	$1171	6.6%
3	2	ICI (U.K.)	17,515	76.0	442	2.5
4	5	Bayer (Germany)	16,312	63.5	988	6.1
5	4	Du Pont (U.S.)	15,571	38.9	1968	12.6
6	6	Dow Chemical (U.S.)	14,690	74.3	1925	13.2
7	8	EniChem (Italy)	12,571	100.0	620	4.9
8	7	Shell (U.K., Netherlands)	12,188	11.5	927	7.6
9	9	Exxon (U.S.)	11,153	9.6	737	6.6
10	10	Rhône-Poulenc (France)	10,122	70.0	585	5.8
11	16	Atochem (France)	9,690	30.0	900	9.3
12	13	Ciba-Geigy (Switzerland)	8,150	57.5	441	5.4
13	11	Union Carbide (U.S.)	7,621[b]	100.0	1033	13.6
14	15	Asahi Chemical (Japan)	6,699[c]	100.0	262[d]	na
15	24	Hüls (Germany)	6,300	100.0	306	4.9
16	19	Akzo (Netherlands)	5,832	61.2	328	5.6
17	17	Monsanto (U.S.)	5,711	63.5	624	10.9
18	25	DSM (Netherlands)	5,580	96.3	495	8.9
19	18	British Petroleum (U.K.)	5,448	6.7	230	5.9
20	20	Mitsubishi Kasei (Japan)	5,321[c]	100.0	128[d]	na
21	14	Solvay (Belgium)	5,292	69.3	na	na
22	23	General Electric (U.S.)	5,167[b]	8.8	1107	19.7
23	21	Occidental Petroleum (U.S.)	5,040	23.2	636	12.6
24	26	Sumitomo Chemical (Japan)	4,950	100.0	115[d]	na
25	22	Norsk Hydro (Norway)	4,924	50.6	368	7.5
26	31	Sekisui Chemical (Japan)	4,144[c]	100.0	180[d]	na
27	27	Amoco (U.S.)	4,087	12.9	252	6.2
28	30	Mobil (U.S.)	4,084	7.7	397	9.7
29	32	Toray Industries (Japan)	4,040[c]	100.0	193[d]	na
30	33	Showa Denko (Japan)	3,934	100.0	78[d]	na
31	28	Takeda Chemical (Japan)	3,833[c]	100.0	266[d]	na
32	34	Saudi Basic Industries (Saudi Arabia)	3,626[e]	100.0	800[d]	na
33	36	Eastman Kodak (U.S.)	3,588	19.0	602	16.8
34	40	W. R. Grace (U.S.)	3,570	52.9	431	12.1
35	37	Dainippon Ink & Chemicals (Japan)	3,489[c]	100.0	57[d]	na
36	39	Roche (Switzerland)	3,438	49.4	na	na
37	38	Chevron (U.S.)	3,325	8.0	44	1.3
38	—	Petrofina (Belgium)	3,259	18.9	367	11.3
39	43	Unilever (U.K., Netherlands)	3,089	7.8	398	22.7
40	42	Mitsui Toatsu Chemicals (Japan)	3,039[c]	100.0	69[d]	na
41	44	Mitsubishi Petrochemical (Japan)	3,000[c]	100.0	179[d]	na
42	12	Degussa (Germany)	2,849[f]	33.1	na	na
43	45	Arco Chemical (U.S.)	2,830	100.0	469	16.6
44	46	Rohm & Haas (U.S.)	2,824	100.0	351	12.4
45	41	Allied-Signal (U.S.)	2,786	22.6	287	10.3
46	47	Air Products (U.S.)	2,614	90.3	441	16.9
47	49	Kemira (Finland)	2,497	83.8	na	na
48	—	Sandoz (Switzerland)	2,465	27.7	na	na
49	—	Courtaulds (U.K.)	2,288	67.0	238	10.4
50	—	Teijin (Japan)	2,279[c]	100.0	138[d]	na

Note: Foreign currencies converted to U.S. dollars using average exchange rate for 1990. a Operating profits as a percentage of sales. b Contains substantial nonchemical sales. c Fiscal year ends March 31. d Net profits. e Unofficial gross sales. f Fiscal year ends Sept. 30. na = not available.

1990, and carried on into the first quarter of this year. We didn't see a slowdown until the second quarter. We have probably reached the flat period, with some signs that economies are going to do a bit better. If interest rates come down, there will be a little bit of an improvement, not materially in the second half of this year, not until 1992."

In fact, the executive believes downturns and upturns work roughly on a six- to seven-quarter period, so with the slowdown, from his viewpoint, starting in the first quarter of 1991, the end would not come until the middle of next year.

"There has been improvement in the sense that for petrochemicals, at least," says securities analyst Tony Church, of Wertheim Schroder in London, "the short-term bottom has been reached. Inventories have been cleared out, and a few plastics prices have come off the floor. But I think the turnaround will be next year, not now. Even the traditional optimists in the chemical industry are cautious this time."

The impact of inventories has been important, agrees Peter Vogtländer, chemicals coordinator of Shell International Chemicals Co. in London. "There has been a bit of an artificial demand last year from the [Persian] Gulf crisis: people worried about prices going up, supply security. So they continued to buy. Then the war was over, and the pipeline full—it is now emptying."

As Vogtländer sees it, the industry's customers—particularly major ones such as automobiles and housing—give no reason for optimism, either in the U.S. or in Europe. "There are indications the recession is bottoming out, but no signs of upturns until early 1992 in the U.S. Europe will be running a good six months behind that. Before that works through to the petrochemical level, it may be the end of 1992. It takes time, and I'm not optimistic."

Plant capacity utilization is by no means at 100%, he adds, but it is not so bad as the early 1980s. "We are facing margins not commensurate with present loadings—I would hope the industry would come to its senses and restore margin levels, maybe not to the levels of 1988–89, but better than now." □